



TFT LCD Approval Specification

MODEL NO.: N150X3-L05

Toshiba Model Name:G33C0001Y110

NOTICE of RECEIPT

We accepted this specification. **OME Operations, TOSHIBA Corp.**

Purchasing dept.	Eng.	Senr. Eng.	Senr. Mgr.
PC Hardware dept.	Eng.	Senr. Eng.	Senr. Mgr.

Liquid Crystal Display Division	
QRA Division.	OA Head Division.
Approval	Approval



Issued Date: Apr.19, 2004
Model No. : N150X3-L05

Approval

CONTENTS

REVISION HISTORY

GENERAL DESCRIPTION

1. ABSOLUTE MAXIMUM RATINGS

- 1.1 ABSOLUTE RATING OF ENVIRONMENT
- 1.2 ELECTRICAL ABSOLUTE RATINGS
- 1.3 MECHANICAL RATINGS
- 1.4 THE OTHERS

2. ELECTRICAL SPECIFICATIONS

- 2.1 TFT LCD MODULE
- 2.2 BACKLIGHT UNIT
- 2.3 MATERIAL LIST CONCERNING EMI REGULATIONS

3. INTERFACE SPECIFICATIONS

- 3.1 THE PIN ASSIGNMENT OF LVDS INTERFACE CONNECTOR
- 3.2 INPUT SIGNAL TIMING SPECIFICATIONS
- 3.3 COLOR DATA INPUT ASSIGNMENT
- 3.4 POWER UP/DOWN SEQUENCE

4. OPTICAL SPECIFICATIONS

- 4.1 TEST CONDITIONS
- 4.2 OPTICAL SPECIFICATIONS

5. MECHANICAL DRAWING

6. PRECAUTION

- 6.1 ASSEMBLY AND HANDLING PRECAUTION
- 6.2 SAFTY PRECAUTION

7. PACKING

- 7.1 PACKING SPECIFICATIONS
- 7.2 PACKING METHOD

8. DEFINITION OF SHIPPING LABEL ON MODULE

Attached 1, Drawing

Attached 2, TFT LCD Inspection Specification



Issued Date: Apr.19, 2004

Model No. : N150X3-L05

Approval**REVISION HISTORY**

Version	Date	Page (New)	Section	Description
3.0	Feb,17,'04	All	All	Final specification was first issued for TSB.
3.1	Mar.30,'04	6	1.3	294mN·m (3.0 kgf·cm)
		9	2.2	Added Leak current
		11	Note (8)	$L_{Leak} = L_{Hot} - L_{Gnd}$ L_{Hot} :Current of Hot L_{Gnd} :Current of GND
		9	2.2	Startup Voltage 1500 Vrms
		13	3.1	Pin 4~7 Non Connection
		16	3.4	Power off → t7
	Apr.12.2004	9	2.1	Add min & max value for Power supply Current
			2.2	Lamp current 6.0mA
		9 & 11	2.3	Delete leakage current & Note 8
		10	note(8)	Modified EMI regulations
		13	3.1	Recover interface connector pin 4~7 assignment
	Apr.14.2004	16	3.4.1	Change t5 & t6
		13	3.1	Delete "equivalent"
		16	3.4.1	Delete $0 < t7 \leq 50$ msec (given by system)
				Delete $0 < t7 \leq 400$ msec (measured on TFT-LCD module)
	Apr.19,2004			Change 10times to 15 times under 245.0 mN·m (2.5 kgf·cm)
		5	1.1	Add Operation temperature for panel & note 2
		6	1.3	Add Operation item in Mechanical Vibration & Mechanical Shock.
		18	4.2	Gamma L32 - 22.5%
		26	8	Definition of shipping label on module



Issued Date: Apr.19, 2004

Model No. : N150X3-L05

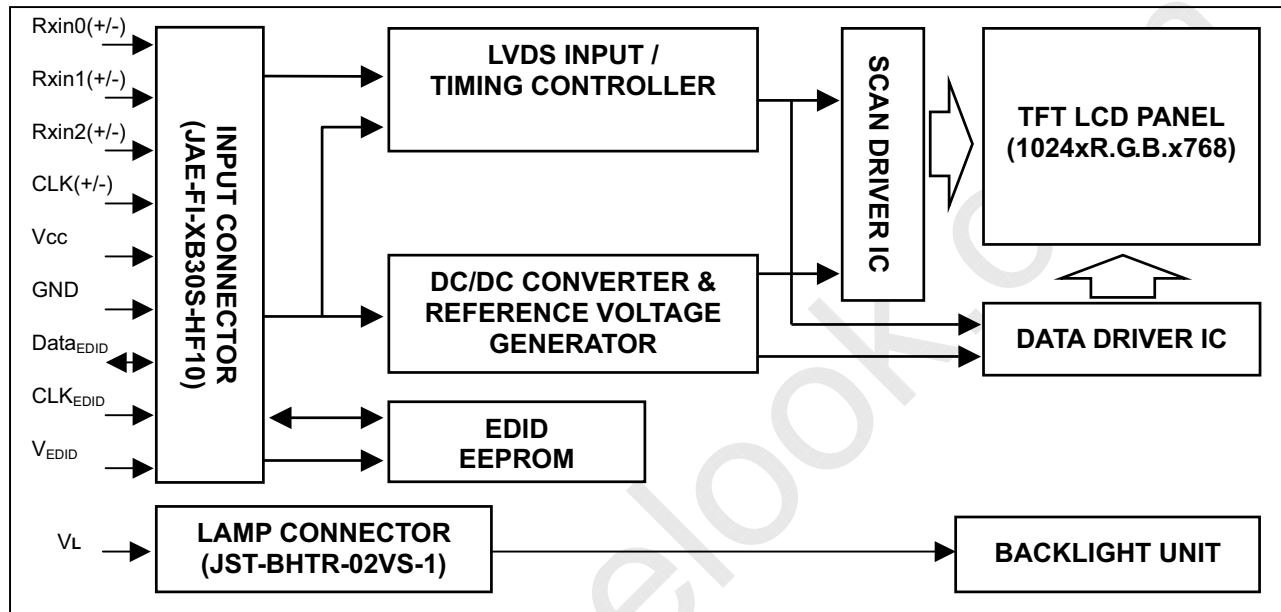
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GENERAL DESCRIPTION

OVERVIEW

This product is a 15" TFT Liquid Crystal Display Module with a Backlight unit and 30 pins LVDS (Low Voltage Differential Signal) interface. This module supports 1024 x 768 XGA mode and can display 262,144 colors. The inverter module for Backlight is not built in.

BLOCK DIAGRAM



APPLICATION

-Note Book PC

GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	304.1 (H) x 228.1 (V) (15.0" diagonal)	mm	(1)
Bezel Opening Area	307.8 (H) x 231.6 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1024 x R.G.B. x 768	pixel	-
Pixel Pitch	0.297 (H) x 0.297 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Anti-glare (Haze 25 %)	-	-

MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	316.8	317.3	317.8	mm	(1)
	Vertical(V)	241.5	242	242.5	mm	
	Depth(D)	5.4	5.7	6.0	mm	
Weight		490	505	520	g	-

Note 1: The maximum thickness of I/O connector area is 6.0mm.

1. ABSOLUTE MAXIMUM RATINGS

1.1 ABSOLUTE RATING OF ENVIRONMENT

Item	Symbol	Min.	Max.	Unit	Note
Operating Ambient Temperature	T _{OP}	0	+50	°C	-
Operating Temperature for Panel	-	0	+60	°C	(2)
Storage Temperature	T _{STG}	-20	+60	°C	-
Operating Ambient Humidity	H _{OP}	20	90	%RH	(1)
Storage Humidity	H _{STG}	10	90	%RH	(1)
Air Pressure	-	70.0	-	kPa	Operation
Air Pressure	-	12.0	-	kPa	Non-Operation
Altitude	-	-	4572	m	Operation
Altitude	-	-	15240	m	Non-Operation

Note. (1) Wet bulb temperature should be 39°C Max, and no condensation of water.

(2) The surface temperature caused by self-heat radiation of cell itself is specific on this item.

1.2 ELECTRICAL ABSOLUTE RATINGS

(1) TFT LCD Module

Parameter	Symbol	Values		Unit	Remarks
		Min.	Max.		
Power supply voltage	V _{CC}	-0.3	+4.0	V	Ta=0~50°C
Logic input voltage	V _{IN}	-0.3	V _{CC} +0.3	V	

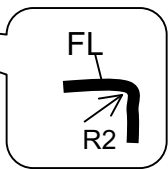
(2) Backlight Unit

Parameter	Symbol	Values		Unit	Remarks
		Min.	Max.		
Lamp voltage	V _L	-	2.5K	V _{RMS}	Note (1)
Lamp current	I _L	1.8	7.0	mA _{RMS}	-
Lamp frequency	f _L	-	80	KHz	-

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

1.3 MECHANICAL RATINGS

LCD shall have no failure in the following reliability items.

Item	Test Conditions		Note
Mechanical Vibration	Frequency Range 5– 500 Hz, 14.7m/s ² (1.5G) constant, 0.5Hrs each axis (X, Y, Z direction)		Non Operation
	Frequency Range 5– 500 Hz, 4.9m/s ² (0.5G) constant, 0.5Hrs each axis (X, Y, Z direction)		Operation
Mechanical Shock	2548m/s ² (260G), Pulse width 2ms, Half-Sine Wave, ±X, ±Y, ±Z direction, each 1 time		Operation & Non Operation
	686m/s ² (70G), Pulse width 11ms, Half-Sine Wave, ±X, ±Y, ±Z direction, each 3 time		Non Operation
Pressure Resistance	No Destruction with the force 196 N (20 kgf, 16 mm in diameter) to the display surface at the vertical direction		Non Operation Fig 1-3-1
	No Destruction with the force 294.2 N (30 kgf, 30 mm in diameter) to the back of the display surface at the vertical direction		Fig 1-3-2 Fig 1-3-3
Strength of FL Cable	Strength of rotation force	Cable: No disconnection of cable to the 5 trial of 360 degree rotation. See a bent state of cable.	Non Operation 
		Connector: No disconnection of cable to 10 trial of 180 degree rotation. See a bent state of cable.	
	Lead pull test	Soldering portion: 14.7N (1.5kgf), 1min	
		Connector: 14.7N (1.5kgf), 1 sec	
Connector tension test	Input connector: With 50 times of connector trial there must be no damage to the shape and functional.		Non Operation
	Back light connector: With 50 times of connector trial there must be no damage to the shape and functional.		
Assured torque value at side-mount part	294mN·m (3.0 kgf·cm)		Non Operation
Re-screwed test	15 times under 245.0 mN·m (2.5 kgf·cm)		Non Operation
Tapping test	Test “ Ripple “ Phenomenon.		Operation

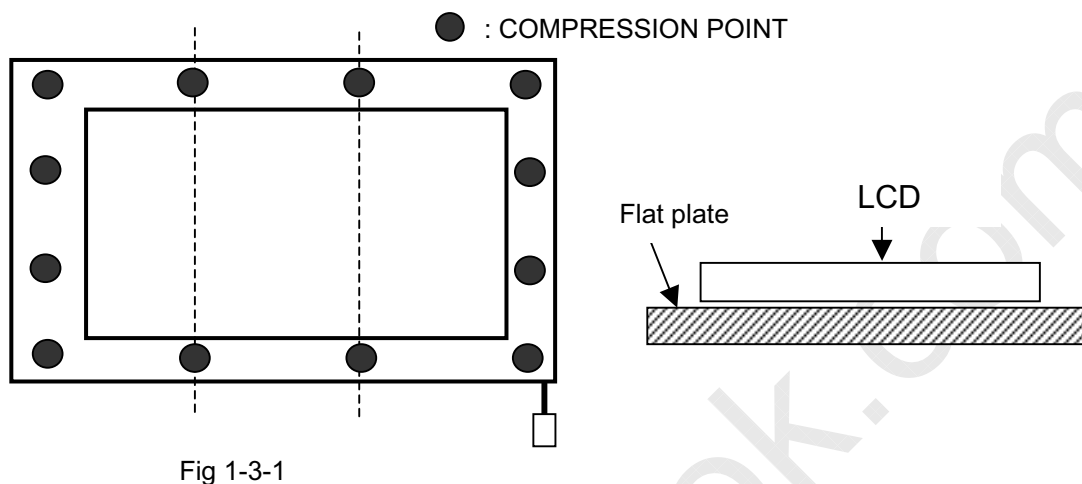
Definitions of failure for judgment shall be as follows:

- 1) Function of the module should be maintained.
- 2) Current consumption should be smaller than the specified value.
- 3) Appearance and display quality should not have distinguished degradation.
- 4) Luminance should be larger than the minimum value specified in optical specification.

NOTE**(1) The compression condition of front side**

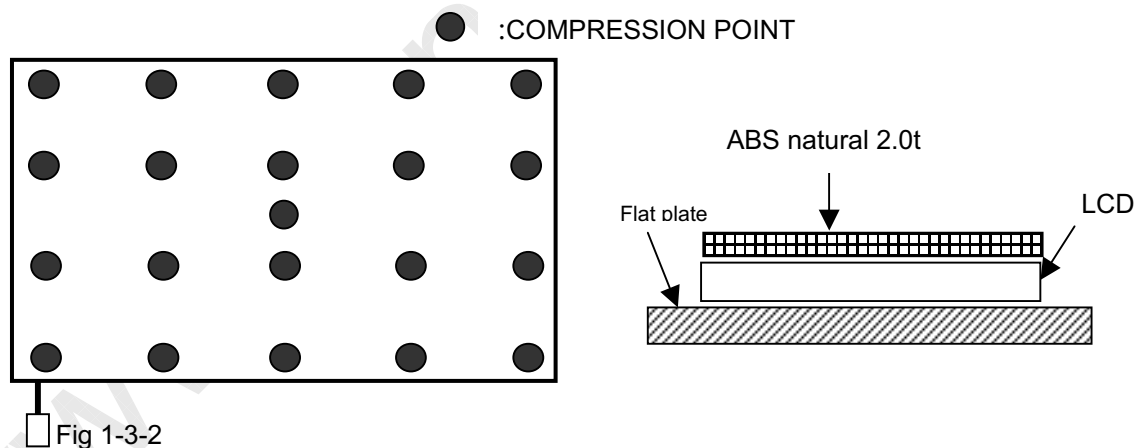
(a) Compression point: 12 points (refer to Fig 1-3-1)

(b) Compression condition: Time 3 sec, Tool diameter: 16 mm in diameter (refer to Fig 1-3-3)

**(2) The compression condition of rear side**

(a) Compression point: 21 points (refer to Fig 1-3-2)

(b) Compression condition: Time 3 sec, Tool radius: 30 mm in diameter (refer to Fig 1-3-3)

**(3) Dimension of the compression jig**

(a) compression jig for front side A = 16 mm in diameter

B = 16 mm in diameter

(b) compression jig for rear side A = 30 mm in diameter

B = 28 mm in diameter

(4) Recommend Torque is 1.3 – 1.5 kgf

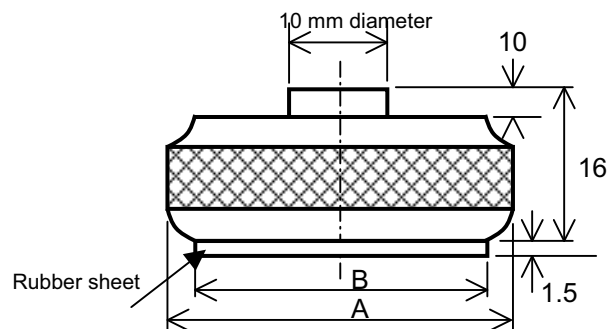


Fig 1-3-3



Issued Date: Apr.19, 2004
Model No. : N150X3-L05

Approval

1.4 THE OTHERS

(1) Static electricity pressure resistance

Items	Testing conditions	Operation	Non Operation
Contact discharge	150pF, 330 ohm	±10 kV	±10 kV
Air discharge	150pF, 330 ohm	±20 kV	±20 kV

ESD Acceptance Definition:

Temporary performance degradation. Recovery by operator is acceptable. No hardware failure.

(2) Sound noise

There should be no uncomfortable noise.

Being used under whatever surrounds, when power on/off, the panel should not generate uncomfortable noise.

(3) Open / Short

No smoke, no fire at any open/ short test

(4) MTBF : 50000 Hr (except for backlight lamp)



Issued Date: Apr.19, 2004
Model No. : N150X3-L05

Approval

2. ELECTRICAL SPECIFICATIONS

2.1 TFT LCD MODULE

MODULE						
Parameter	Symbol	Value			Unit	Notes
		Min.	Typ.	Max.		
Power Supply Voltage	V_{CC}	3.0	3.3	3.6	V	(1)
"H" level LVDS signal input	V_{IH}	-	-	+100	mV	
"L" level LVDS signal input	V_{IL}	-100	-	-	mV	
Power Supply Current	White	250	300	350	mA	(9)
	Black	340	400	450	mA	
	Maximum	530	580	630	mA	
Rush Current	I_{RUSH}	-	1.2	1.5	A	(2)
Ripple voltage	V_{RP}	-	50	-	mV	(1)
Terminating resistor	R_t	-	100	-	Ohm	

LCD Fuse name: Kamaya(FCC16-162ABTP)

2.2 BACKLIGHT UNIT

LAMP : Sanken/SS20D3100N6570C2802570S

BACKLIGHT (1 Lamp)						
Parameter	Symbol	Value			Unit	Notes
		Min.	Typ.	Max.		
Lamp Voltage	V_L	608	675	743	V_{RMS}	$I_L=6.5mA$
Lamp Current	I_L	2.0	6.0	6.5	mA	(3)
Startup Voltage	V_S	-	-	1150 (25°C)	V_{RMS}	(4)
		-	-	1500 (0 °C)	V_{RMS}	(4)
Operating Frequency	F_L	40	60	80	KHz	(5)
Power Consumption	P_L	-	4.4	-	W	(6), $I_L=6.5mA$
Lamp Life time	L_{BL}	10000	15000	-	Hrs	(7)

The connector information of Black light unit.

Pin	Symbol	Description	Remark
1	HV	Lamp power input	Pink
2	LV	Ground	White

Note (1) Connector PN.: **BHTR-02VS-1** or equivalent

Note (2) User's connector Part No.: SM02B-BHTS-B-TB or equivalent

2.3 MATERIAL LIST CONCERNING EMI REGULATIONS

(1) EMI Regulations:

"N150X3-L05" which is assembled inside Toshiba's notebook should be met to the regulations as below:

CISPR: Pub.22 Class B

FCC : Part 15 Class B

VCCI : Class B



Issued Date: Apr.19, 2004

Model No. : N150X3-L05

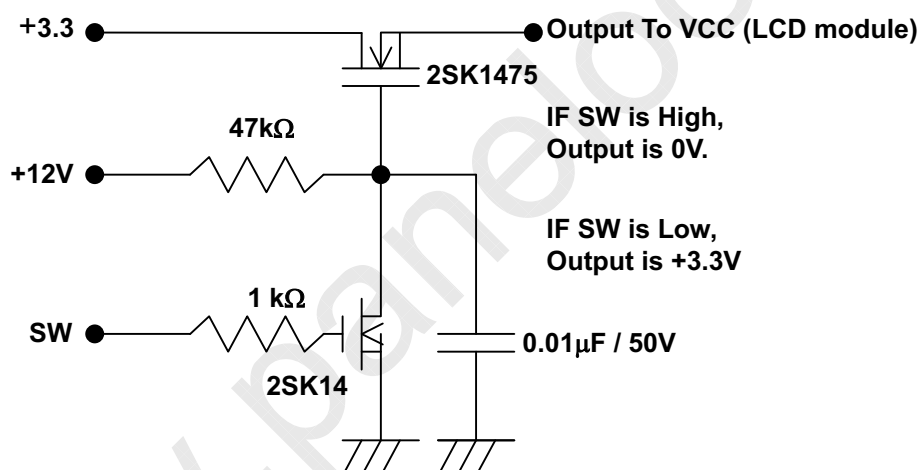
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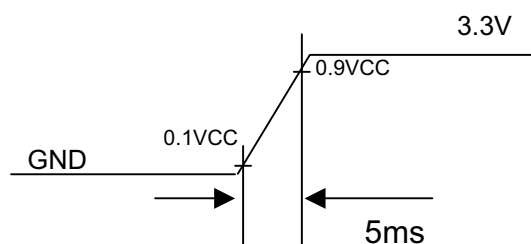
(2) Safety regulation (CMO TFT-LCD module only): UL 1950

1. EMI Filter	Silk	Product Code	Rating	Maker
Bead	R407	BK1608 LL241	240 Ohm/100MHz	TAIYO YU DEN Co.,JPN
Bead array	LA1~LA9	BK3216 4M121	120 Ohm/100MHz	TAIYO YU DEN Co.,JPN
Chip Resistor Array	LA10	N/A	33 Ohm	N/A
Bead	R406,424	BK1608 LL121	120 Ohm / 100MHz	TAIYO YO DEN Co.,JPN
Bead	L1,L2	CMD5D11-100MC	10uH,+/-20%,0.54 A,H=1.2mm(Max)	Sumida
Chip Resistor	L101,L102,R211,L401,L403	N/A	0 Ohm	
2. DC/DC Converter	Silk	Osc. Freq.		Maker
PWM IC	U9	Typ 1.2 MHz.		Linear Technology

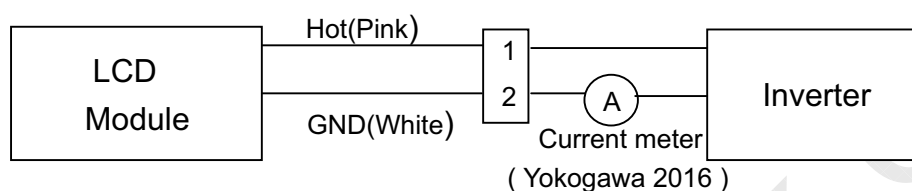
Note (1) Operating Temp. range is 0 ~ 50 °C

Note (2) Measurement Conditions is as below. Them maximum Vcc drop voltage that caused by rush current when switching-on should not be more than 0.5V.



VCC rising time is 5ms


Note (3) Lamp current is measured by utilizing a current meter for high frequency as shown below:



Note (4) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (5) The lamp frequency may produce interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (6) $P_L = I_L \times V_L$.

Note (7) The lifetime (Hr) of a lamp can be defined as the time in which it continues to operate under the condition $T_a = 25 \pm 2^\circ\text{C}$ and $I_L = 2.0 \sim 6.5 \text{ mArms}$ until one of the following event occurs :

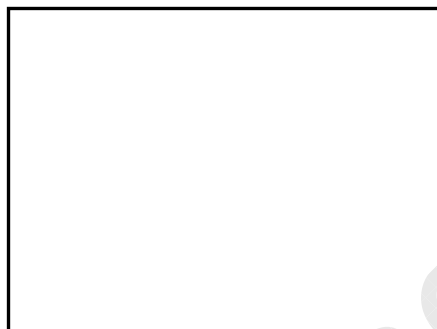
- (1) When the brightness becomes 50% or lower than its original,
 - (2) When the effective ignition length becomes 80% or lower than its original value.
- (Effective ignition length is defined as an area that has less than 70% brightness compared to the brightness in the center point.)

Note (8) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be designed with care so as not to produce too much current leakage from high-voltage output of the inverter. When designing or ordering the inverter, please make sure that a poor lighting caused by the mismatch of the backlight and the inverter (miss-lighting, flicker, etc.) never occurs.

When the above situation is confirmed, the module should be operated in the same manners as it is installed in your instrument.

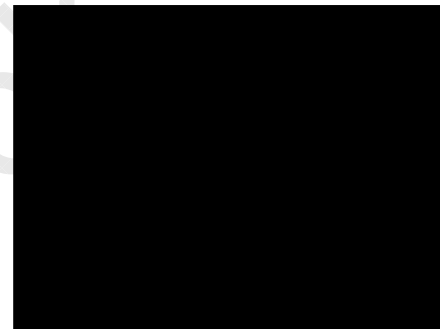
Note (9) The specified power supply current is under the conditions, $T_a = 25 \pm 2^\circ\text{C}$, $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed. In case of white pattern and black pattern, the maximum value is measured when $V_{CC}=3.0\text{V}$, the typical value is measured when $V_{CC}=3.3\text{V}$ and the minimum value is measured when $V_{CC}=3.6\text{V}$. In case of maximum pattern, the maximum value is measured when $V_{CC}=3.6\text{V}$, the typical value is measured when $V_{CC}=3.3\text{V}$ and the minimum value is measured when $V_{CC}=3.0\text{V}$.

a. White Pattern

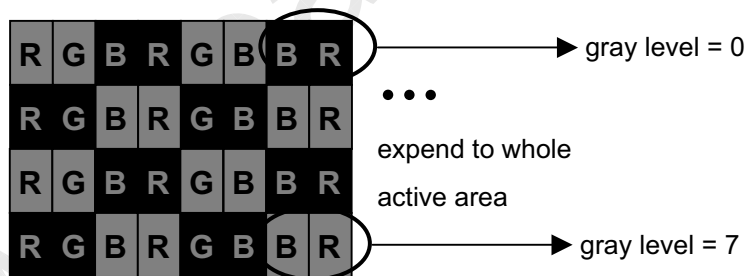


Active Area

b. Black Pattern



c. Maximum pattern (Zoom in)



... expend to whole active area



Issued Date: Apr.19, 2004

Model No. : N150X3-L05

Approval

3. INTERFACE SPECIFICATIONS

3.1 THE PIN ASSIGNMENT OF LVDS INTERFACE CONNECTOR.

Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		
2	Vcc	Power Supply +3.3 V (typical)		
3	Vcc	Power Supply +3.3 V (typical)		
4	V _{EDID}	EDID VCC		DDC 3.3V Power
5	NC	Non-Connection		
6	CLK _{EDID}	EDID Clock		DDC Clock
7	DATA _{EDID}	EDID Data		DDC Data
8	Rxin0-	LVDS Differential Data Input	Negative	R0~R5,G0
9	Rxin0+	LVDS Differential Data Input	Positive	
10	Vss	Ground		
11	Rxin1-	LVDS Differential Data Input	Negative	G1~G5,B0,B1
12	Rxin1+	LVDS Differential Data Input	Positive	
13	Vss	Ground		
14	Rxin2-	LVDS Differential Data Input	Negative	B2~B5,DE,Hsync,Vsync
15	Rxin2+	LVDS Differential Data Input	Positive	
16	Vss	Ground		
17	CLK-	LVDS Clock Data Input	Negative	LVDS Level Clock
18	CLK+	LVDS Clock Data Input	Positive	
19	Vss	Ground		
20	NC	Non-Connection		
21	NC	Non-Connection		
22	Vss	Ground		
23	NC	Non-Connection		
24	NC	Non-Connection		
25	Vss	Ground		
26	NC	Non-Connection		
27	NC	Non-Connection		
28	Vss	Ground		
29	NC	Non-Connection		
30	NC	Non-Connection		

Note (1) Connector Part No.: JAE-FI-XB30S-HF10.

Note (2) User's connector Part No: JAE-FI-X30M.

Note (3) The first pixel is even.

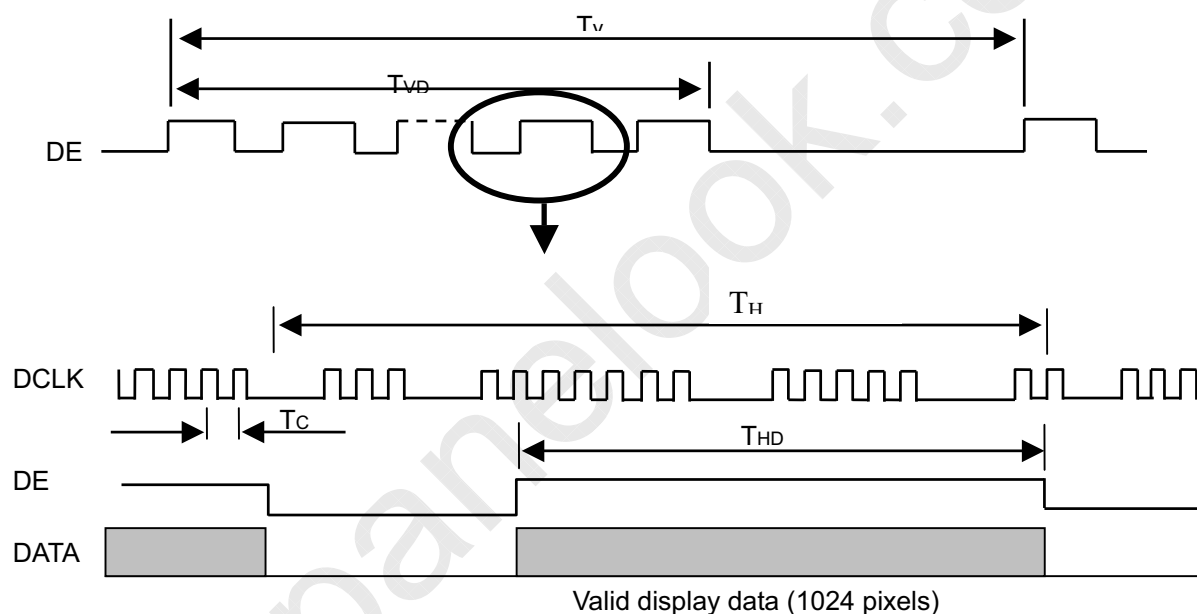
3.2 INPUT SIGNAL TIMING SPECIFICATIONS

The specifications of input signal timing are as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	1/Tc	50	65	68	MHz	-
Vertical Total Time	Cycle	TV	771	806	850	TH	-
Vertical Addressing Time	Display Period	TVD	768	768	768	TH	-
Horizontal Total Time	Cycle	TH	1200	1344	1500	Tc	-
Horizontal Addressing Time	Display Period	THD	1024	1024	1024	Tc	-

Note (1) The duration of DE signal must be longer than 1 clock period at every horizontal sync.period.

INPUT SIGNAL TIMING DIAGRAM





Issued Date: Apr.19, 2004

Model No. : N150X3-L05

Approval

3.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
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	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage



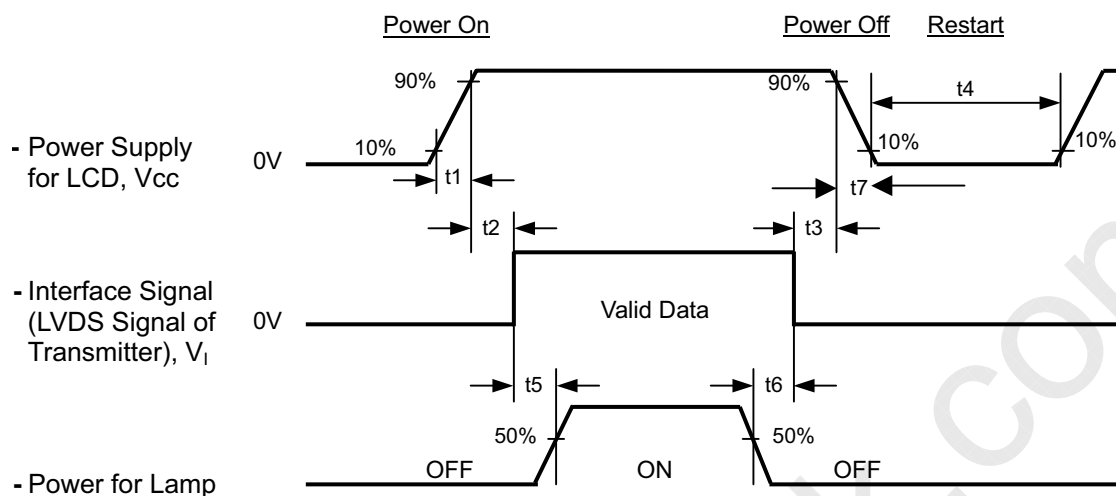
Issued Date: Apr.19, 2004

Model No. : N150X3-L05

Approval

3.4 POWER UP/DOWN SEQUENCE & VCC DIP CONDITIONS

3.4.1 POWER UP/DOWN SEQUENCE



Timing Specifications:

$$470\mu\text{s} \leq t_1 \leq 10 \text{ msec}$$

$$0 < t_2 \leq 50 \text{ msec}$$

$$0 < t_3 \leq 50 \text{ msec}$$

$$t_4 \geq 500 \text{ msec}$$

$$t_5 \geq 100 \text{ msec}$$

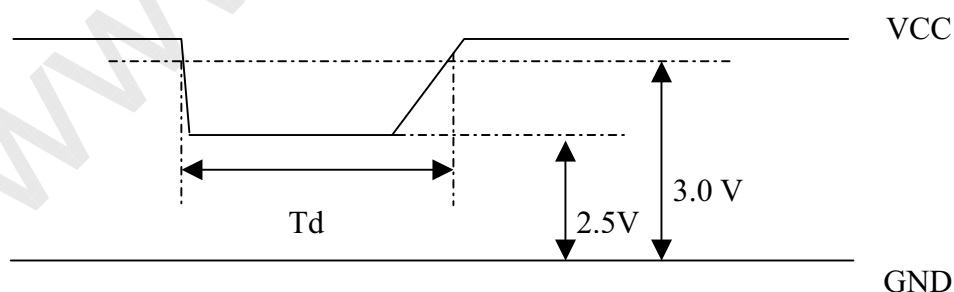
$$t_6 \geq 100 \text{ msec}$$

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

3.4.2 VCC DIP CONDITIONS



$$(1) 2.5\text{V} \leq V_{CC} < 3.0\text{V}$$

$$T_d \leq 20 \text{ ms}$$

$$(2) V_{CC} < 2.5\text{V}$$

Vcc-Dip conditions also follow the power up/down conditions for supply voltage.

4. OPTICAL SPECIFICATIONS

4.1 TEST CONDITIONS

Ambient Temperature : $T_a = 25 \pm 2^\circ\text{C}$

Ambient Humidity : $H_a = 50 \pm 10\% \text{RH}$

Supply Voltage : $V_{cc} = 3.3\text{V}$

Input Signal : According to typical value in "Electrical Characteristics"

FL Input Current : $I_{FL} = 6.0\text{mA}_{rms}$

FL Driving Frequency : $f_{FL} = 50\text{ kHz}$

FL Inverter : H05-4915 (Sumida)

The measuring method is shown in 4.2. The following items are measured under stable conditions. The optical characteristics should be measured in a dark room (Screen luminance < 2-lx) or equivalent state with the methods shown in Note (6).

4.2 OPTICAL SPECIFICATIONS

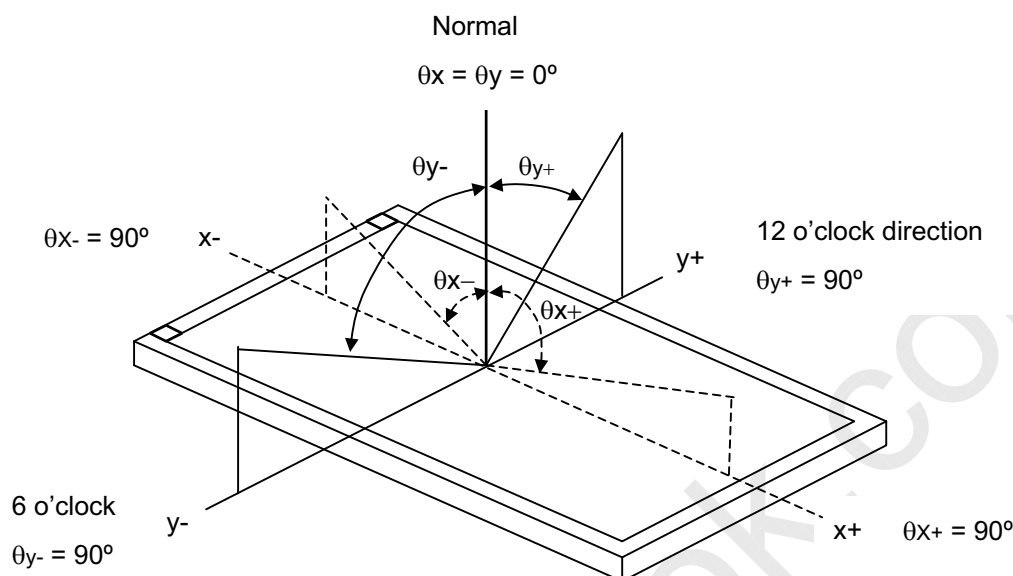
Item		Symbol	Conditions	Specifications			Unit	Note
				Min.	Typ.	Max.		
Contrast Ratio		CR _{AVE}	θ _x = θ _y =0° Viewing normal angle	200	250	-	-	(2),(6)
Response Time		T _R		-	6	10	ms	(3)
		T _F		-	17	25	ms	
Average luminance of white (5 points)		Y _{L,AVE}		130	160	-	cd/m ²	I _{FL} =6.0mA _{rms} * Gray Scale Level=L63 (White) (4)
Cross Modulation		D _{SHA}		-	-	1.0	%	(5)
Luminance Uniformity Chromaticity	Red	R _x		0.570	0.600	0.630	-	(1), (6)
		R _y		0.313	0.343	0.373	-	
	Green	G _x		0.294	0.324	0.354		
		G _y		0.506	0.536	0.566		
	Blue	B _x		0.122	0.152	0.182		
		B _y		0.102	0.132	0.162		
	White	W _x		0.283	0.313	0.343	-	
		W _y		0.299	0.329	0.359	-	
Viewing Angle	Hor.	θ _{x+}	Center CR>=10	40	45	-	deg.	(1), (6)
		θ _{x-}		40	45	-		
	Ver.	θ _{y+}		15	20	-		
		θ _{y-}		35	40	-		
	Hor.	θ _{x+}	Center CR>=5	50	55	-		
		θ _{x-}		50	55	-		
	Ver.	θ _{y+}		25	30	-		
		θ _{y-}		40	45	-		
13 Points White Variation		δ W	θ _x = θ _y =0° Viewing normal angle	1.0	1.3	1.6	-	(7)
13 Points CR Variation		δ C _R		-	2.0	2.5	-	(7)
White Variation		dL		-	-	1.5	%/mm	(8)

**CHI MEI**
OPTOELECTRONICS CORP.Issued Date: Apr.19, 2004
Model No. : N150X3-L05**Approval**

Item	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Gamma	0	$\theta_x = \theta_y = 0^\circ$ Viewing normal angle	-	0.0%	-	%	(1) (6) at center of Viewing area center only
	4		-	0.2%	-		
	8		-	1.1%	-		
	12		-	2.6%	-		
	16		-	4.9%	-		
	20		-	8.0%	-		
	24		-	12.0%	-		
	28		-	16.8%	-		
	32		-	22.5%	-		
	36		-	29.2%	-		
	40		-	36.8%	-		
	44		-	45.4%	-		
	48		-	55.0%	-		
	52		-	65.6%	-		
	56		-	77.2%	-		
	60		-	89.8%	-		
	63		-	100.0%	-		

PS. Because of the color measurement discrepancy between TSB & CMO is ($\Delta W_x, \Delta W_y$)=>(0.01,0.009),

Note (1) Definition of Viewing Angle θ_x and θ_y :



Note (2) Definition of Contrast Ratio :

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

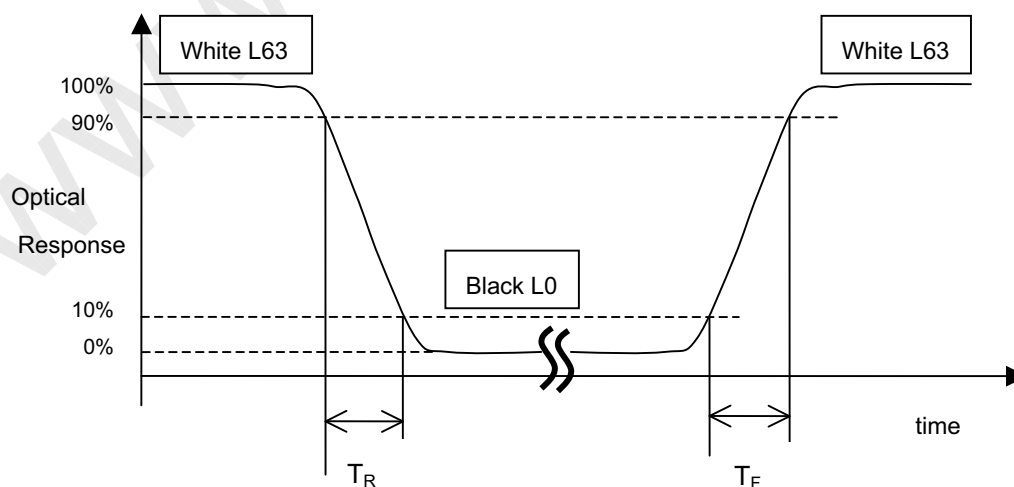
L_{63} : Luminance on the white raster (gray scale level L_{63})

L_0 : Luminance on the black raster (gray scale level L_0)

$$CR_{AVE} = (CR(4) + CR(5) + CR(7) + CR(9) + CR(10)) / 5$$

$CR(X)$ is correspond to the Contrast Ratio of a point of X at Figure of Note (7).

Note (3) Definition of Response time :



Note (4) Definition of Average Luminance of White :
measure the luminance of white at 5 points.

Average Luminance of White $Y_{L,AVE}$

$$Y_{L,AVE} = (Y_{L4} + Y_{L5} + Y_{L7} + Y_{L9} + Y_{L10}) / 5$$

Y_{LX} is correspond to the Luminance of a point of X at Figure of Note (7).

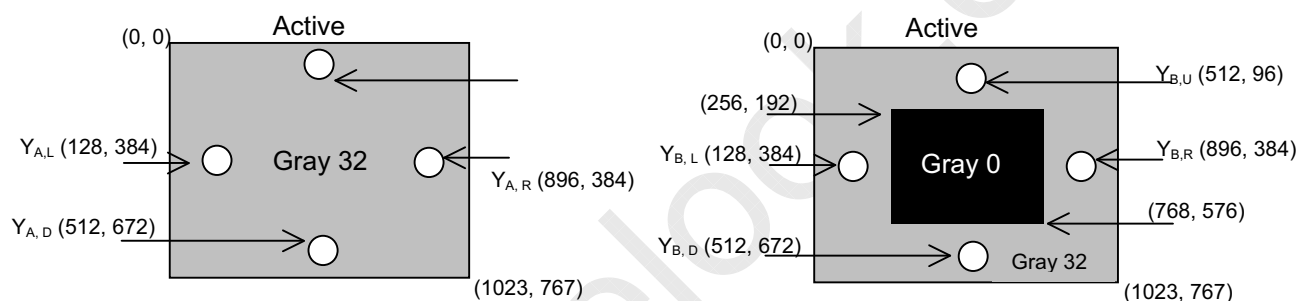
Note (5) Definition of Cross Modulation (D_{SHA})

$$D_{SHA} = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where :

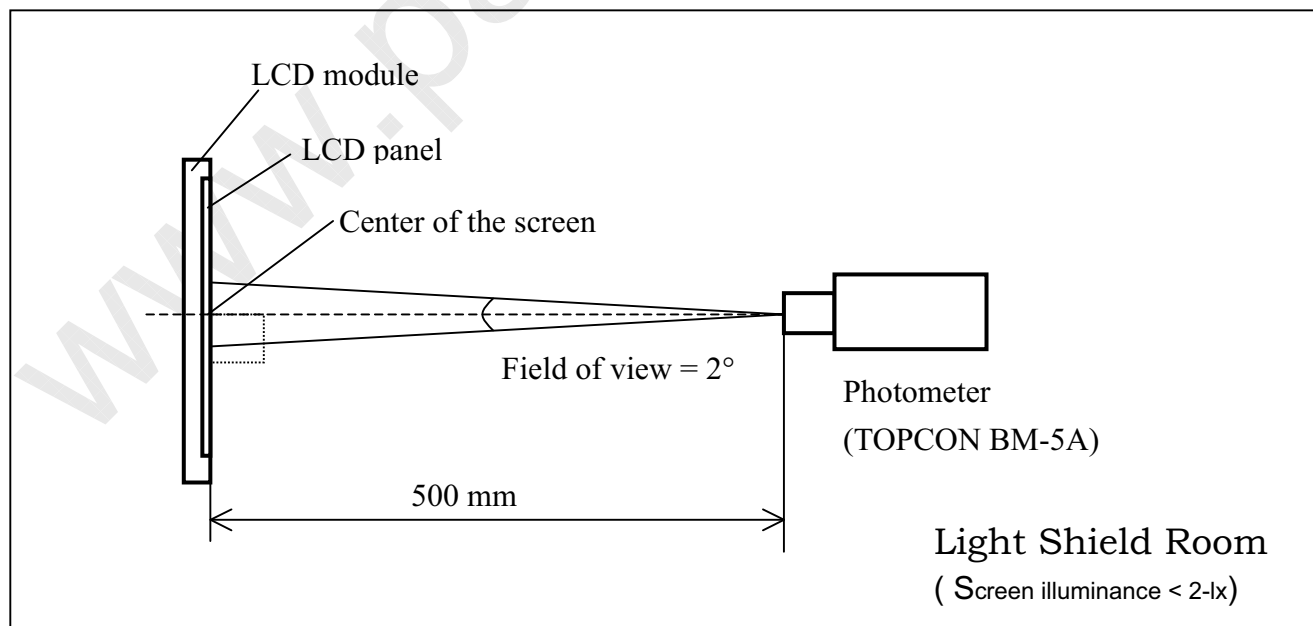
Y_A = Luminance of measured location without darkest gray pattern (cd/m^2)

Y_B = Luminance of measured location with darkest gray pattern (cd/m^2)



Note (6) Measuring setup :

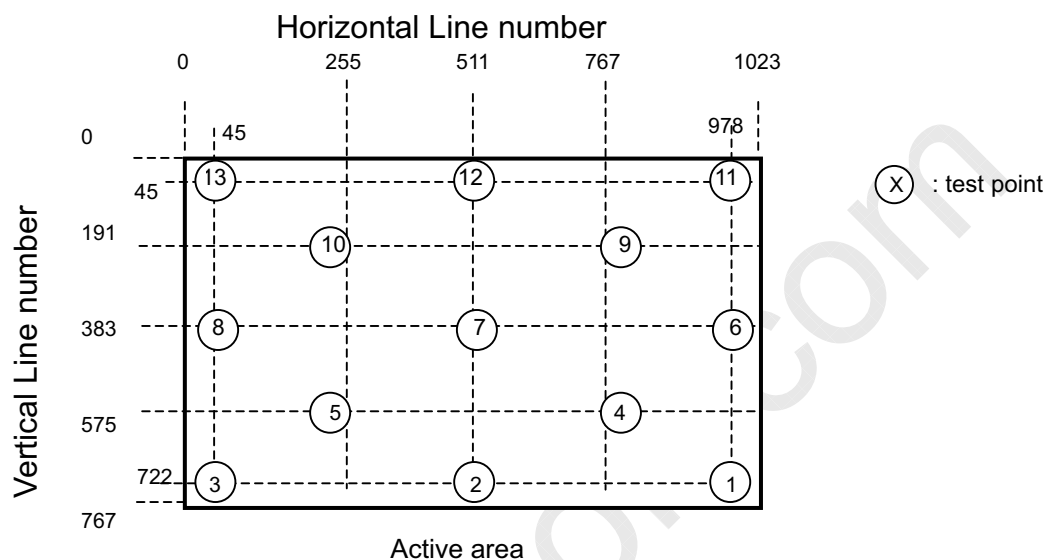
The measurement suppose to be executed after stabilized the panel at given temperature during 30min. in the case of abrupt temperature change. The measurement shall be executed 30 minutes after lighting at rating. The luminance of white should be typical luminance (Typical Condition $IL=6.0\text{mA}$). In order to stable the luminance, LCD shall not be gotten winds.



Note (7) Definition of 13 points white variation δW , CR variation δC_R

δW = Maximum luminance of 13 points / Minimum luminance of 13 points

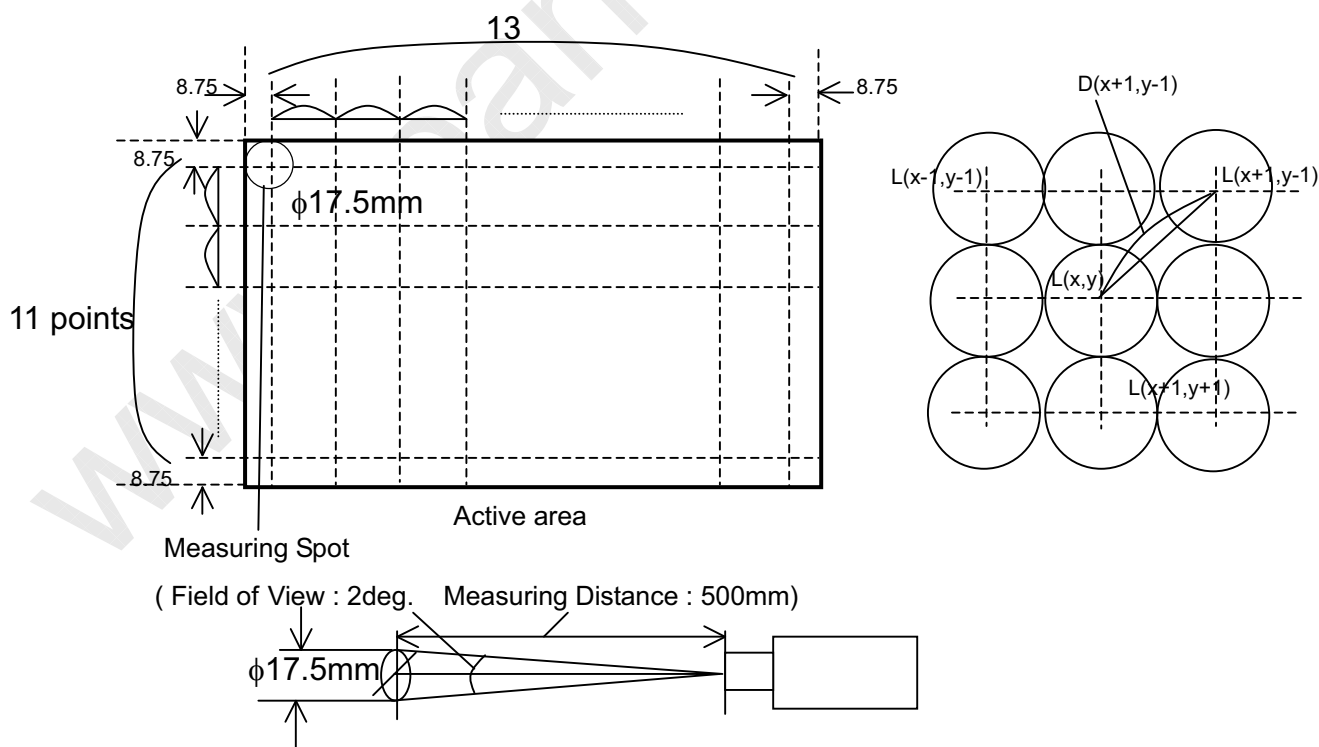
δC_R = Maximum CR 13 points / Minimum CR of 13 points



Note (8) Definition of White Variation dL : measure the luminance of white at 13×11 points.

$$dL = |L(x,y) - L(x+l, y+j)| / (L(x,y) \times D(x+l, y+j)) \times 100 \quad (\%/mm)$$

where $2 \leq x \leq 12$, $2 \leq y \leq 10$, $l = \pm 1$, $j = \pm 1$





Issued Date: Apr.19, 2004
Model No. : N150X3-L05

Approval

5. MECHANICAL DRAWING

Please refer to the attached drawings.

6. PRECAUTION

6. 1 ASSEMBLY AND HANDLING PRECAUTION

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) To assemble or install module into user's system can be only in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
- (3) It's not permitted to have pressure or impulse on the module because the LCD panel and backlight will be damaged.
- (4) Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latchup.
- (5) Do not pull the I/F connector in or out while the module is operating.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
- (9) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (10) When ambient temperature is lower than 10°C may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

6.2 SAFTY PRECAUTION

- (1) The startup voltage of backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.

7. PACKAGING

7.1 PACKING SPECIFICATIONS

- (1) 20 LCD modules / 1 Box
- (2) Box dimensions : 511(L) X 420(W) X 360(H) mm
- (3) Weight : approximately 14Kg (20 modules per box)

7.2 PACKING METHOD

- (1) Carton Packing should have no failure in the following reliability test items.

Test Item	Test Conditions	Note
Vibration	Frequency Range: 5 – 50 Hz, Degree of acceleration 9.8 m/s^2 (1G). Sweep rate 3 minutes Top & Bottom 60 minutes, Right & Left 15 minutes, Back & Forth 15 minutes	Non Operation
Dropping Test	1 Angle, 3 Edge, 6 Face, 60cm	Non Operation

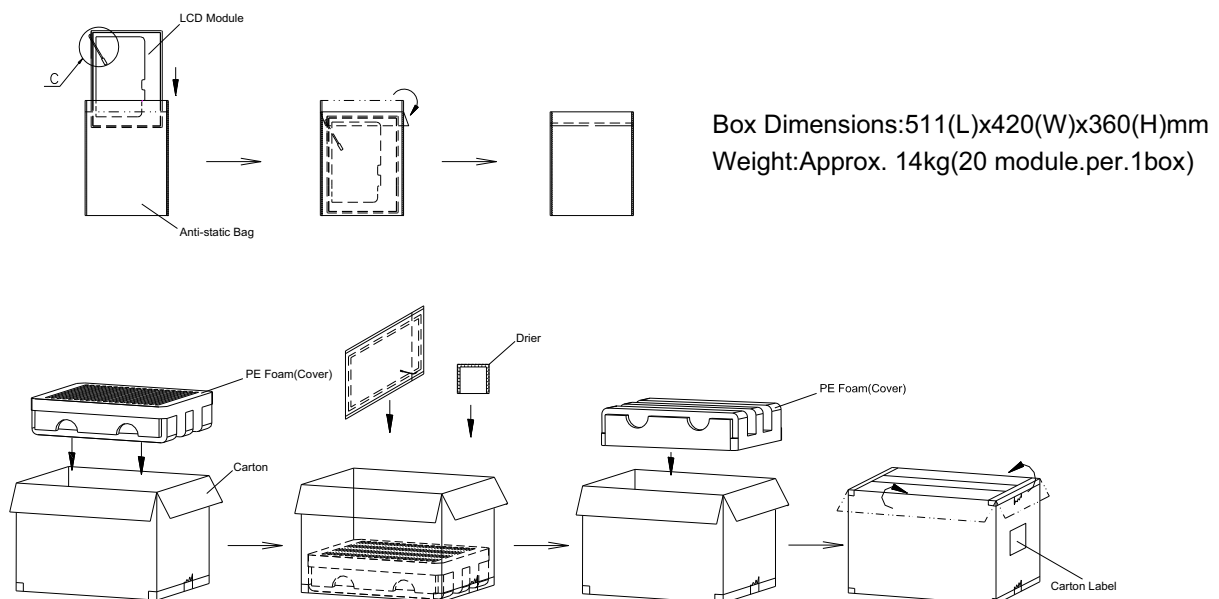


Figure. 7-1 Packing method

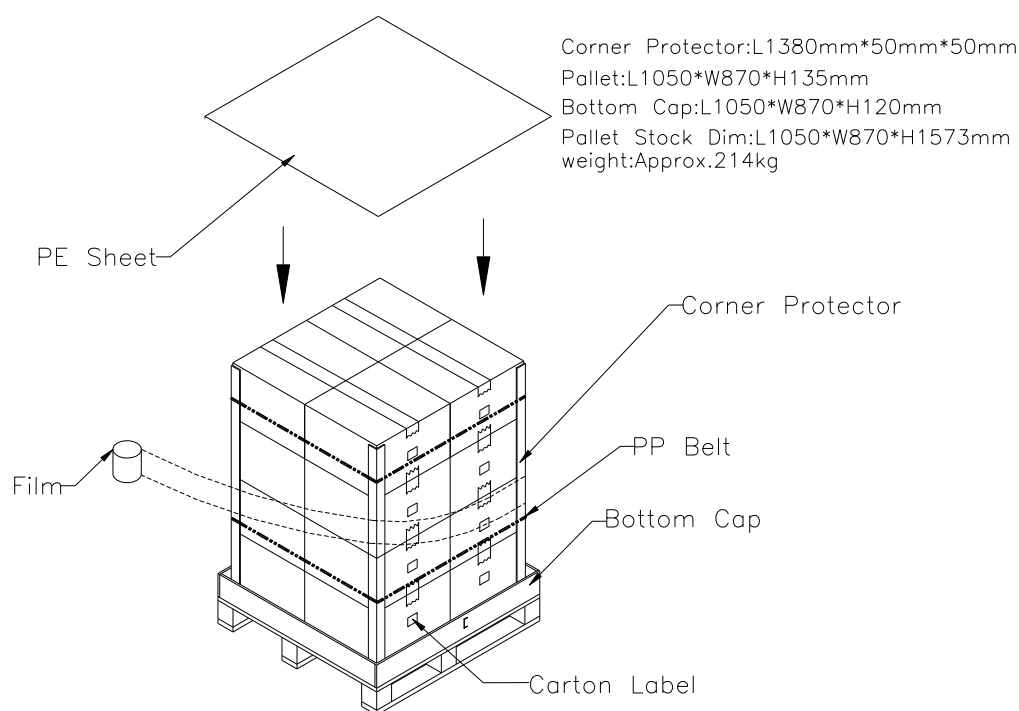


Figure. 7-2 Packing method



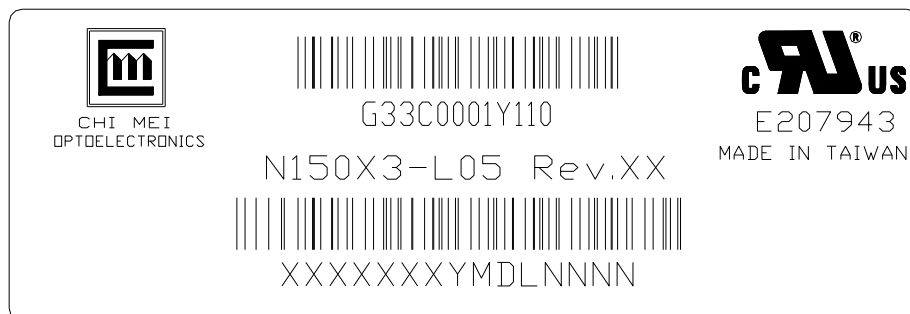
Issued Date: Apr.19, 2004
Model No. : N150X3-L05

Approval

8. DEFINITION OF SHIPPING LABEL ON MODULE

(1) CMO Label

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

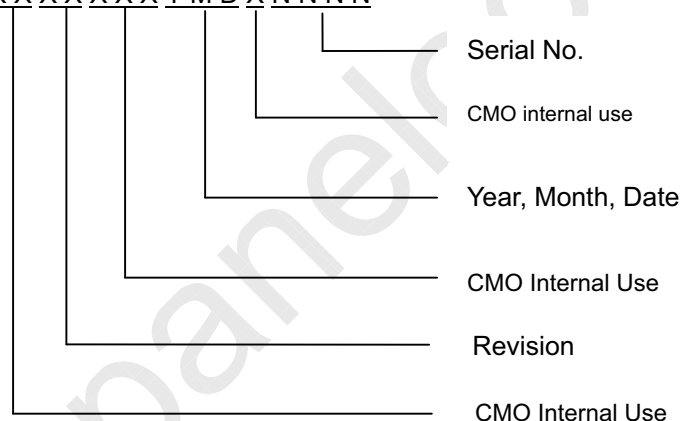


70mm X 24mm

(a) Model Name : N150X3-L05

(b) Revision : Rev.XX, for example : C1, C2 ...etc.

(c) Serial ID: X X X X X X Y M D X N N N N



Serial ID include the information as list.

(a) Manufactured Date: Year: 1~9, for 2001~2009

Month: 1~9, A~C, for Jan. ~ Dec.

Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

(d) Product Line: 1 -> Line1, 2 -> Line 2, ...etc.



Issued Date: Apr.19, 2004
Model No. : N150X3-L05

Approval

(2) Carton Label

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PO.NO. _____

Part ID. G33C0001Y110

Model Name _____

Carton ID. _____ Quantities _____

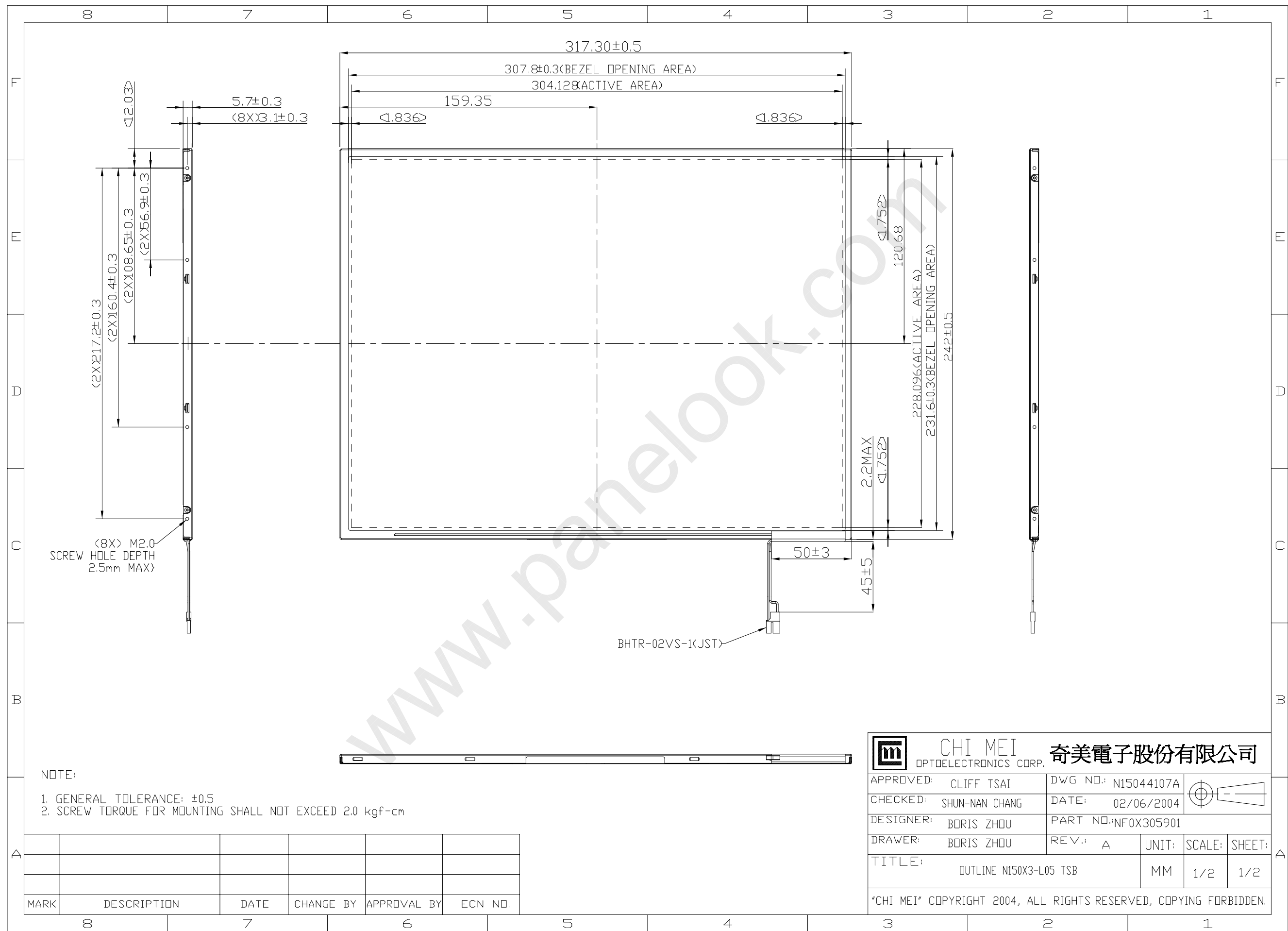
(3) Pallet Label

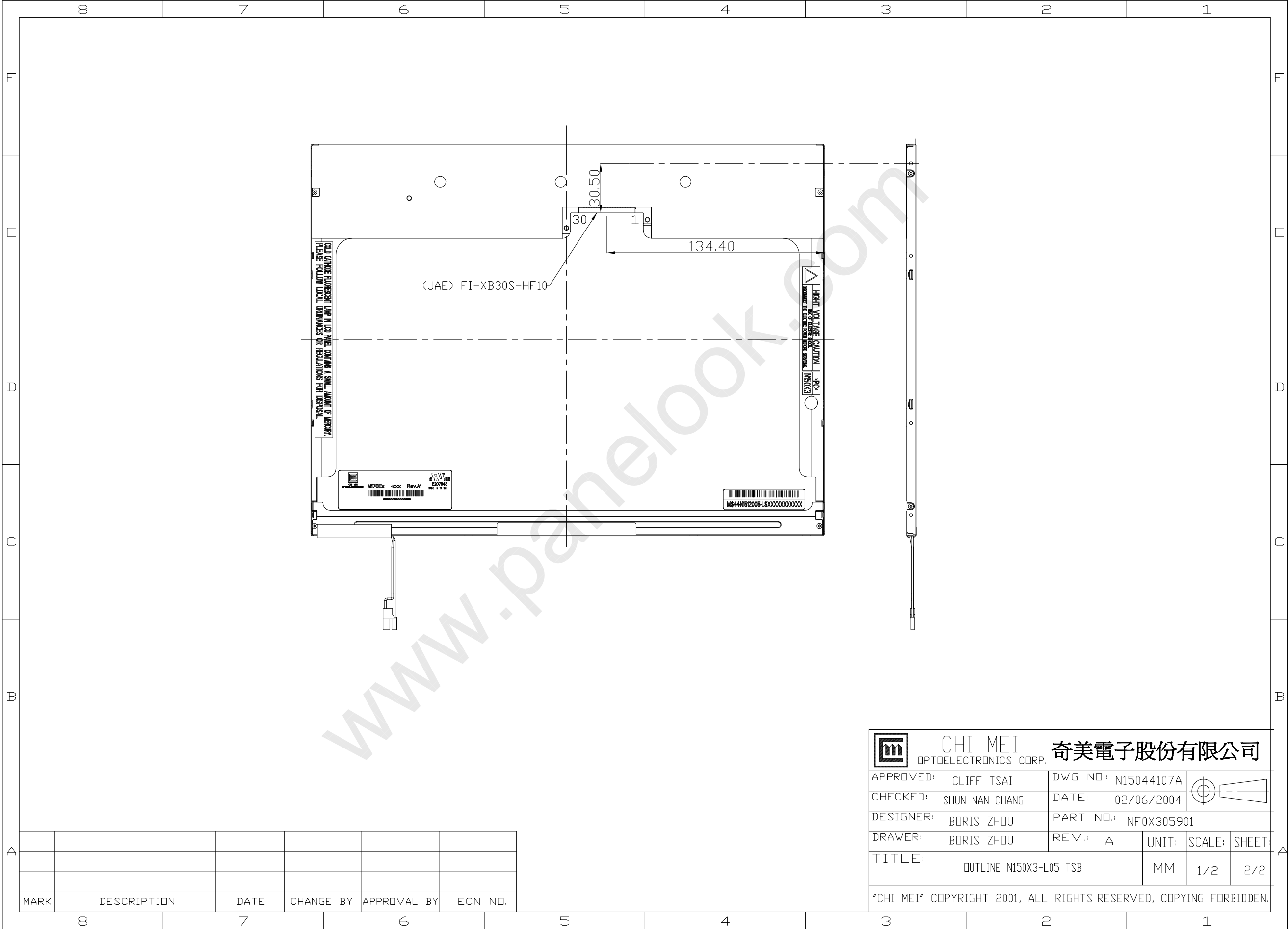
CHI MEI OPTOELECTRONICS

Product code: G33C0001Y110

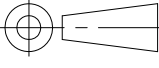
PO number: _____

Quantity: _____





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APPROVED: CLIFF TSAI	DWG NO.: N15044107A		
CHECKED: SHUN-NAN CHANG	DATE: 02/06/2004		
DESIGNER: BORIS ZHOU	PART NO.: NF0X305901	A	
DRAWER: BORIS ZHOU	REV.: A		
TITLE: OUTLINE N150X3-L05 TSB			
	UNIT: MM	SCALE: 1/2	SHEET: 2/2
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